

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions of claims in the application.

1-6. (Cancelled).

7. (Currently Amended): A liquid crystal display in IPS mode,
wherein [[the]] an optical film ~~according to claim 1~~ is arranged on a cell substrate on a viewing side,
a polarizing plate comprising a transparent protective film laminated on both sides of a polarizer is arranged on a cell substrate opposite to the viewing side, and
an extraordinary refractive index direction of a liquid crystalline substance in a liquid crystal cell and an absorption axis of the polarizing plate are parallel, in a state where voltage is not applied,

wherein the optical film is a laminate in which plural retardation films are laminated on one side of a polarizing plate obtained by laminating a transparent protective film on both sides of a polarizer so that a retardation film (a) and a retardation film (b) are laminated in this order from the polarizing plate side, and the absorption axis of the polarizing plate is parallel to the slow axes of the two retardation films,

wherein

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

an Nz value expressed by $Nz = (nx_1 - nz_1)/(nx_1 - ny_1)$ is in the range of from 0.72 to 0.78 for the retardation film (a) and in the range of from 0.22 to 0.28 for the retardation film (b) and

an in-plane retardation Re_1 expressed by $Re_1 = (nx_1 - ny_1) \times d_1$ is in the range of from 200 to 350 nm,

where in each of the plural retardation films, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_1 , ny_1 , and nz_1 , respectively, and the thickness of the film as d_1 (nm),

wherein

the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin,

wherein

an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less,

and

a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2)/2 - nz_2\} \times d_2$ is 30 nm or less,

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as n_{x_2} , n_{y_2} , and n_{z_2} , respectively, and the thickness of the film as d_2 (nm),
and wherein the optical film is arranged so that the retardation films are laminated on the liquid crystal cell-side of the polarizing plate.

8. (Currently Amended): A liquid crystal display in IPS mode,
wherein a polarizing plate comprising a transparent protective film laminated on both sides of a polarizer is arranged on a cell substrate on a viewing side,

~~[[the]]~~ an optical film according to claim 1 is arranged on a cell substrate opposite to the viewing side, and

an extraordinary refractive index direction of a liquid crystalline substance in a liquid crystal cell and an absorption axis of the optical film are perpendicular, in a state where voltage is not applied,

wherein the optical film is a laminate in which plural retardation films are laminated on one side of a polarizing plate obtained by laminating a transparent protective film on both sides of a polarizer so that a retardation film (a) and a retardation film (b) are laminated in this order from the polarizing plate side, and the absorption axis of the polarizing plate is parallel to the slow axes of the two retardation films,

wherein

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

an Nz value expressed by $Nz = (nx_1 - nz_1)/(nx_1 - ny_1)$ is in the range of from 0.72 to 0.78 for the retardation film (a) and in the range of from 0.22 to 0.28 for the retardation film (b) and

an in-plane retardation Re_1 expressed by $Re_1 = (nx_1 - ny_1) \times d_1$ is in the range of from 200 to 350 nm,

where in each of the plural retardation films, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_1 , ny_1 , and nz_1 , respectively, and the thickness of the film as d_1 (nm),

wherein

the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin,

wherein

an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less,
and

a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2)/2 - nz_2\} \times d_2$ is 30 nm or less,

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as n_{x_2} , n_{y_2} , and n_{z_2} , respectively, and the thickness of the film as d_2 (nm), and wherein the optical film is arranged so that the retardation films are laminated on the liquid crystal cell-side of the polarizing plate.

9. (Previously Presented): The liquid crystal display according to Claim 7, wherein the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin.

10. (Previously Presented): The liquid crystal display according to claim 7, wherein an in-plane retardation expressed by $R_{e2} = (n_{x_2} - n_{y_2}) \times d_2$ is 20 nm or less, and a thickness direction retardation expressed by $R_{th} = \{(n_{x_2} + n_{y_2}) / 2 - n_{z_2}\} \times d_2$ is 30 nm or less,

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as n_{x_2} , n_{y_2} , and n_{z_2} , respectively, and the thickness of the film as d_2 (nm).

11. (Cancelled).

12. (Previously Presented): The liquid crystal display according to Claim 8, wherein the

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin.

13. (Previously Presented): The liquid crystal display according to Claim 8, wherein an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less, and a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2) / 2 - nz_2\} \times d_2$ is 30 nm or less,

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_2 , ny_2 , and nz_2 , respectively, and the thickness of the film as d_2 (nm).

14-15. (Cancelled).

16. (Previously Presented): The liquid crystal display according to claim 7, wherein, in the optical film, the absolute value of a difference in Nz value between the retardation film (a) and the retardation film (b) is in the range of from 0.4 to 0.6.

17-20. (Cancelled).

21. (Previously Presented): The liquid crystal display according to claim 8, wherein, in the optical film, the absolute value of a difference in Nz value between the retardation film (a) and the retardation film (b) is in the range of from 0.4 to 0.6.

22-23. (Cancelled).

24. (New): A liquid crystal display in IPS mode, wherein an optical film is arranged on a cell substrate on a viewing side, a polarizing plate comprising a transparent protective film laminated on both sides of a polarizer is arranged on a cell substrate opposite to the viewing side, and an extraordinary refractive index direction of a liquid crystalline substance in a liquid crystal cell and an absorption axis of the polarizing plate are parallel, in a state where voltage is not applied,

wherein the optical film is a laminate in which plural retardation films are laminated on one side of a polarizing plate obtained by laminating a transparent protective film on both sides of a polarizer so that a retardation film (b) and a retardation film (a) are laminated in this order from the polarizing plate side, and the absorption axis of the polarizing plate is perpendicular to the slow axes of the two retardation films,

wherein

an Nz value expressed by $Nz = (nx_1 - nz_1)/(nx_1 - ny_1)$ is in the range of from 0.72 to 0.78 for the retardation film (a) and in the range of from 0.22 to 0.28 for the retardation film (b) and

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

an in-plane retardation Re_1 expressed by $Re_1 = (nx_1 - ny_1) \times d_1$ is in the range of from 200 to 350 nm,

wherein each of the plural retardation films, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_1 , ny_1 , and nz_1 , respectively, and the thickness of the film as d_1 (nm),

wherein

the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin,

wherein

an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less,

and

a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2)/2 - nz_2\} \times d_2$ is 30 nm or less,

wherein the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_2 , ny_2 , and nz_2 , respectively, and the thickness of the film as d_2 (nm),

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

and wherein the optical film is arranged so that the retardation films are laminated on the liquid crystal cell-side of the polarizing plate.

25. (New): The liquid crystal display according to claim 24, wherein the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin.

26. (New): The liquid crystal display according to claim 24, wherein an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less, and a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2) / 2 - nz_2\} \times d_2$ is 30 nm or less, and

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_2 , ny_2 , and nz_2 , respectively, and the thickness of the film as d_2 (nm).

27. (New): The optical film according to claim 24, wherein the absolute value of a difference in Nz value between the retardation film (a) and the retardation film (b) is in the range of from 0.4 to 0.6.

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

28. (New): A liquid crystal display in IPS mode,
wherein a polarizing plate comprising a transparent protective film laminated on both sides of a polarizer is arranged on a cell substrate on a viewing side,
an optical film is arranged on a cell substrate opposite to the viewing side, and
an extraordinary refractive index direction of a liquid crystalline substance in a liquid crystal cell and an absorption axis of the optical film are perpendicular, in a state where voltage is not applied,

wherein the optical film is a laminate in which plural retardation films are laminated on one side of a polarizing plate obtained by laminating a transparent protective film on both sides of a polarizer so that a retardation film (b) and a retardation film (a) are laminated in this order from the polarizing plate side, and the absorption axis of the polarizing plate is perpendicular to the slow axes of the two retardation films,

wherein

an Nz value expressed by $Nz = (nx_1 - nz_1)/(nx_1 - ny_1)$ is in the range of from 0.72 to 0.78 for the retardation film (a) and in the range of from 0.22 to 0.28 for the retardation film (b) and

an in-plane retardation Re_1 expressed by $Re_1 = (nx_1 - ny_1) \times d_1$ is in the range of from 200 to 350 nm,

where in each of the plural retardation films, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

in each axial direction are defined as nx_1 , ny_1 , and nz_1 , respectively, and the thickness of the film as d_1 (nm),

wherein

the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin,

wherein

an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less,

and

a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2)/2 - nz_2\} \times d_2$ is 30 nm or less,

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_2 , ny_2 , and nz_2 , respectively, and the thickness of the film as d_2 (nm),

and wherein the optical film is arranged so that the retardation films are laminated on the liquid crystal cell-side of the polarizing plate.

29. (New): The liquid crystal display according to claim 28, wherein the transparent protective film laminated on at least one side of the polarizing plate comprises a thermoplastic saturated norbornene resin.

Application No.: 10/572,600
Attorney Docket No.: 062272
Response under 37 CFR §1.111

30. (New): The liquid crystal display according to claim 28, wherein an in-plane retardation expressed by $Re_2 = (nx_2 - ny_2) \times d_2$ is 20 nm or less, and a thickness direction retardation expressed by $Rth = \{(nx_2 + ny_2) / 2 - nz_2\} \times d_2$ is 30 nm or less,

where in the transparent protective film laminated on at least one side of the polarizing plate, a direction along with the refractive index in the film plane is maximum is defined as the X-axis, a direction perpendicular to the X-axis as the Y-axis, the thickness direction of the film as the Z-axis, and where refractive indices in each axial direction are defined as nx_2 , ny_2 , and nz_2 , respectively, and the thickness of the film as d_2 (nm).

31. (New): The optical film according to claim 28, wherein the absolute value of a difference in Nz value between the retardation film (a) and the retardation film (b) is in the range of from 0.4 to 0.6.